REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-018

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	April 1995	

4. TITLE AND SUBTITLE

Site Characterization and Analysis Penetrometer System

5. FUNDING NUMBERS

6. AUTHOR(S)

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESSE(S)

Naval Facilities Engineering Service Center
Port Hueneme, CA 93043-4328

8. PERFORMING ORGANIZATION REPORT NUMBER

TDS-2016-ENV

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESSES

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The **site characterization and analysis penetrometer system** (SCAPS) with **laser induced fluorescence** (LIF) sensors is being demonstrated as a quick field screening technique to determine the physical and chemical characteristics of subsurface soil and contaminants at hazardous waste sites. SCAPS is a collaborative development effort of the Navy, Army, and Air Force under the Tri-Service SCAPS Program. The current SCAPS configuration is designed to quickly and cost-effectively distinguish areas contaminated with petroleum products (hydrocarbons) from unaffected areas.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Site characterization and analysis penetrometer system (SCAPS), laser induced fluorescence (LIF), rapid optical screening tool (ROST)	2
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

TechData Sheet

TDS-2016-ENV **April 1995**

Naval Facilities Engineering Service Center
Port Hueneme, California 93043-4328

SERDP
Strategic Environmental Research and Development Program
A Partnership to Improve the Environment

Site Characterization and Analysis Penetrometer System

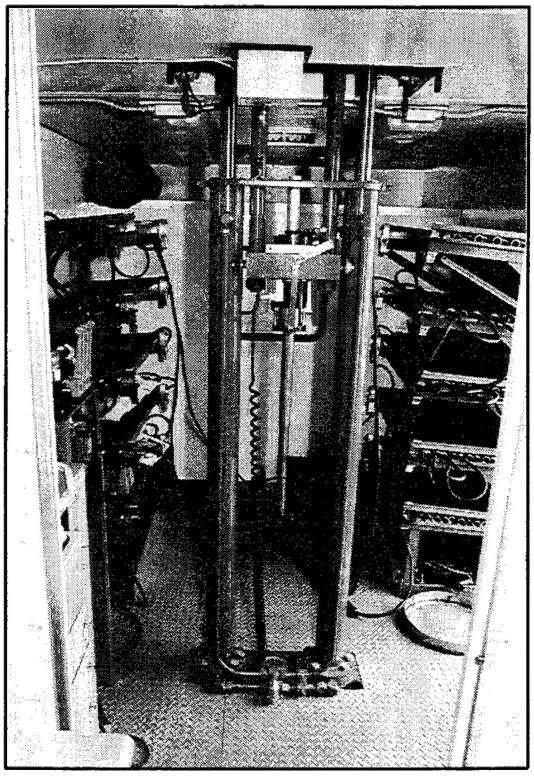

Figure 1

INTRODUCTION

The **site characterization and analysis penetrometer system** (SCAPS) with **laser induced fluorescence** (LIF) sensors (see Figure 1) is being demonstrated as a quick field screening technique to determine the physical and chemical characteristics of subsurface soil and contaminants at hazardous waste sites.

SCAPS is a collaborative development effort of the Navy, Army, and Air Force under the Tri-Service SCAPS Program. The current SCAPS configuration is designed to quickly and cost-effectively distinguish areas contaminated with petroleum products (hydrocarbons) from unaffected areas.

PURPOSE OF SCAPS AT PORT HUENEME

The SCAPS project at the Construction Battalion Center (CBC) in Port Hueneme is to obtain acceptance of SCAPS Laser Induced Fluorescence Technology by environmental regulators and develop a SCAPS field screening method. The SCAPS technology will also be evaluated for its:

1. Reliability, ruggedness, cost, and range of usefulness.
2. Specific data quality objectives.
3. Easy operation.

ADVANTAGES

A site characterization and analysis penetrometer system using laser induced fluorescence can define the boundaries of a hydrocarbon plume. With the boundaries defined, data analysis can be performed to indicate the least number of monitoring wells required for long-term plume movement and contaminants breakdown measurements. Investigation and remediation decisions can be made efficiently and effectively on site. This capability reduces the number of samples that need to be submitted to a laboratory for costly confirmatory analysis.

TECHNICAL DESCRIPTION

SCAPS laser induced fluorescence (LIF) sensor technology will be demonstrated as a field screening technique for real time in place subsurface field detection and identification of petroleum, oil and lubricant hydrocarbons. An entire group of sensors is planned for eventual deployment using the SCAPS delivery platform (see Figure 1). The SCAPS and its family of sensors will provide rapid, in place, subsurface measurements of many different contaminants and soil.

The SCAPS is a suite of equipment mounted on a specially engineered 6 x 6 truck (60,000-pound weight class) designed for operations at hazardous waste sites (see Figure 2). The truck van contains a room for data collection; and a room for hydraulic controls and penetrometer equipment. The heart of SCAPS is the sensors. These special sensors are designed to detect petroleum products and to determine soil characteristics. The hydraulic penetrometer thrust system pushes the penetrometer rod into the soil at a rate of 3 feet per minute. The penetrometer tip is equipped with sensors that can determine the physical characteristics of the soil as the rod is pushed through the soil. The tip has strain gauges that yield compression and push rod friction data. This data are used in a classification scheme to identify the types of soil and different layers encountered by the push rod probe.

One configuration to be demonstrated is a monochromatic (single light wavelength) LIF sensor and support system that is currently used in the Army and Navy SCAPS units. The second configuration, which is Air Force developed, uses a tunable (selective light wavelength) dye laser-equipped induced fluorescence system, called the **rapid optical screening tool** (ROST). Both systems deliver laser energy and ultraviolet light to the soil through a sapphire window near the probe's tip. The laser energy excites the contaminant molecules, thus generating light (fluoresce) at different wave lengths. The resulting contaminant fluorescent energy passes back through the window and travels through a second fiber optic cable to the surface for collection and analysis. SCAPS employs an **optical multichannel analyzer** for signal detection processing and display. The fluorescent response measurement is directly related to concentration of the petroleum contaminant in the soil.ROST employs a **photo multiplier tube** approach in which a selected light wavelength can be used to cause contaminants to fluoresce. Thus identification of specific petroleum compounds is possible.

The demonstration is designed to highlight the LIF SCAPS and ROST technology as a field screening method by comparing real-time in place data to data produced by conventional sampling and analytical methods. For the purposes of the demonstration, conventional sampling and analysis will consist of taking soil samples from along the edge of SCAPS's push holes. Portions of the samples will be submitted to an analytical laboratory to support verification of the LIF SCAPS and ROST capability to characterize subsurface geology and soil parameters.

If you are interested in more information about SCAPS, contact Mr. Jeff Heath, Manager, Technology Application Branch, Code ESC414, at (805) 982-1657 or DSN: 551-1657, or call our 24-hour number: (805) 982-5070 or DSN: 551-4070.

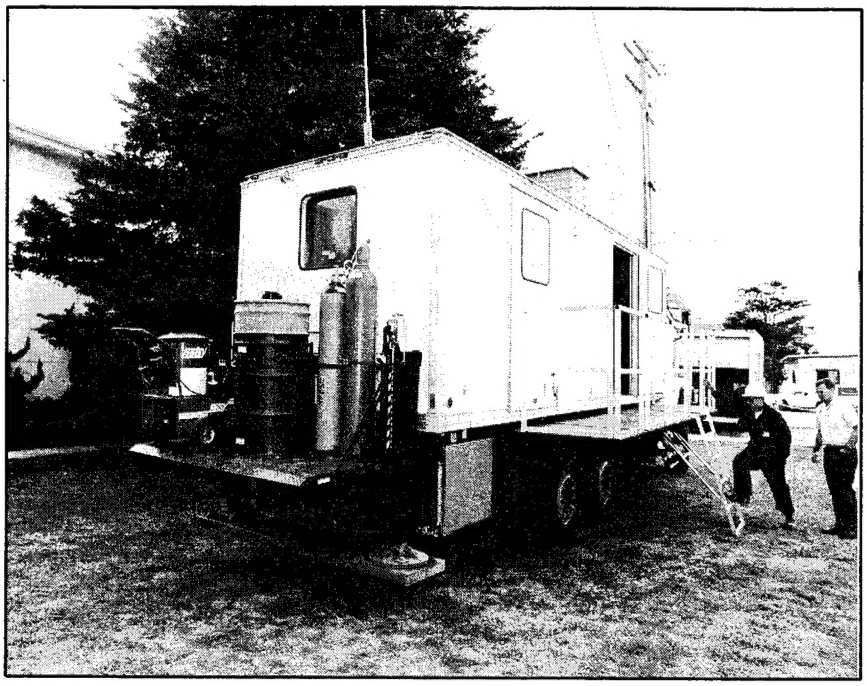

Figure 2